Data-Assimilative, Nested Nowcast/Forecast Models for the Mediterranean Sea: Multiscale Environmental Assessment Network Studies (MEANS)

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LONG-TERM GOAL

Our long-term goal is to explore the utility and skill of the combined use of numerical ocean models and advanced technology in the form of in-situ sampling devices such as Autonomous Underwater Vehicles (AUVs) and Autonomous Environmental Profilers (AEPs) in estimating the state of the ocean. One potential application is Rapid Environmental Assessment (REA) in littoral regions of naval interest.

OBJECTIVES

A primary objective is to assess the impact of adaptive sampling using AUVs on model nowcast/ forecast skill in littoral waters at spatial scales of 10-20 km. Another is to assess the utility of AEPs in improving the nowcast/forecast skill by providing improved input on the vertical structure to numerical models.

APPROACH

The nowcast/forecast system will be based on nested ocean models assimilating both satellite remotely sensed and in-situ data (Figure 1). The chosen venue is the Procchio Bay off the island of Elba in the western Mediterranean Sea. The context is the GOATS 2000 (Generic Ocean Array Technology Sonar) experiment in year 2000, a joint undertaking of the NATO SACLANT Undersea Research Center in La Spezia, Italy, and MIT researchers funded by the Office of Naval Research. The MEANS effort is a supplement to GOATS and is a joint undertaking of Harvard (Dr. Allan Robinson), SACLANT Center (Dr. Lakshmi Kantha) and MIT (Dr. Henrik Schmidt). The PI is spending his sabbatical year at the Center to carry out this research, and is supported jointly by the ONR and the Center. The approach will be to establish an ensemble of data-assimilative, nested, nowcast/forecast models of the oceanic state for the Mediterranean Sea, going from the basin scales (1000-2000 km) down to local bay scales (10-20 km). The basin scale model assimilates remotely-sensed data and any in-situ data available basin-wide. The local model will assimilate AUV and AEP data, while the regional model will be initialized by and assimilate data collected by NATO RV Alliance during the experiment. Adaptive sampling issues will be explored on local scales using AUVs and Alliance.

WORK COMPLETED

Work has just begun on this project, but considerable progress has been made. Since the real-time operational products generated by the US Navy operational centers FNMOC and NAVOCEANO are

crucial to the success of this endeavor, considerable effort has been expended in effecting a routine transfer of such data from CNMOC to the SACLANT center. A memorandum of agreement is nearly in place and the mechanics of data transfer are being worked out. This will ensure the timely availability of nowcast/forecasts of the oceanic and atmospheric state for the Mediterranean Sea at resolutions of 10 km and approximately 25 km respectively. These in turn will be used to drive higher resolution models telescoping down to sub-kilometer resolutions at the local scale.

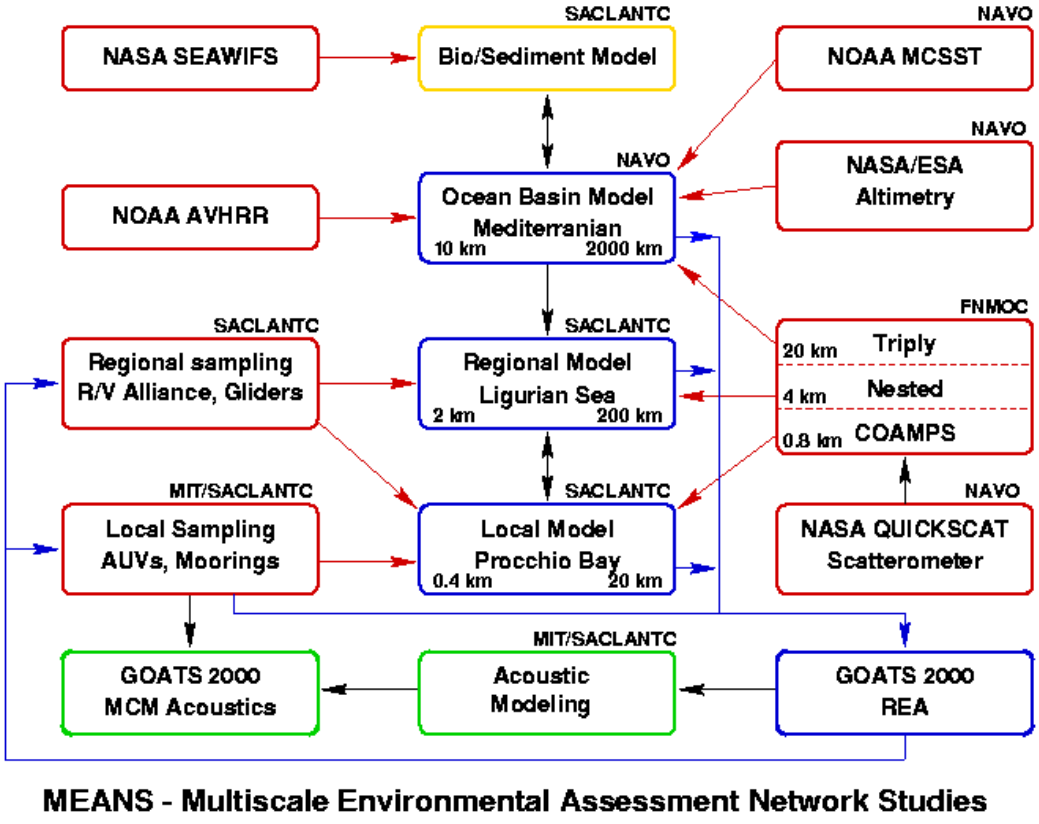

Figure 1: The MEANS nowcast/forecast system

A GOATS/MEANS joint planning meeting was held at the SACLANT Center on October 21st and 22nd. Details of the MEANS modeling effort and data collection efforts by NRV Alliance and the 3 AUVs in its support were discussed. The current plan is to have a quadruple nest with the outer two models (Mediterranean Sea and Ligurian Sea) making use of the NAVO/CU versions of Princeton Ocean Model (POM) and the inner two based on the Harvard Ocean Prediction System (HOPS). Real-time nowcast/forecasts and adaptive sampling strategies will be explored at the local scale.

RESULTS

None at this time.

IMPACT/APPLICATIONS

The end of cold war has seen a shift in naval strategy from keeping sea lines across the ocean basins open to projecting power across the littoral. This shift has placed emphasis on accurate assessment of the environmental state in coastal regions of the world. REA in shallow water for amphibious and mine clearance operations requires application of advanced technology such as AUVs and AEPs in combination with skillful numerical models. Results from this study will help assess the feasibility and utility of this approach. It will also set up a nowcast/forecast system of potential use to NATO fleet operations and exercises.

TRANSITIONS

None at this time

RELATED PROJECTS

The GOATS 2000 experiment is a closely related project.